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RAMIE.

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RAMIE.

INTRODUCTION.

Ramie (*Boehmeria nivea*) has been an important fiber-producing plant in China for many centuries. Experiments in the cultivation of ramie have been carried on in this country since 1860. Although none of them thus far have led to a commercial industry, interest in the possibility of cultivating ramie continues. Ramie fiber, long, strong, durable, light, lustrous, and nonelastic, is in some respects the most attractive plant fiber of commerce. Several kinds of ramie goods are appearing in increasing quantities in our markets. Some mills are now engaged in the manufacture of these goods in the United States, and others are being equipped for the work. There are more inquiries for information about ramie than about any other fiber-producing plant.

THE PLANT.

The ramie plant (fig. 1) is a perennial belonging to the nettle family and is native in eastern Asia. Herbaceous stalks one-eighth to one-half of an inch in thickness and 2 to 6 feet in height, similar to those of the nettle, but without stinging hairs, grow up each year from the perennial rootstocks. When cut during the growing season, new shoots grow up. The leaves are broadly ovate, serrate, green above, and downy white on the under surface.

RANGE OF CULTURE.

Ramie is cultivated commercially in China, in Japan, including Taiwan (Formosa), in Chosen (Korea), and to a limited extent in India and Africa. It has never been cultivated on a commercial scale in this country, but experiments conducted by private individuals, State experiment stations, and by the United States Department of Agriculture have demonstrated that it can be grown on suitable soils from Maryland to Texas; also in California and in Porto Rico.

CLIMATE.

A warm, moist climate is essential for the successful cultivation of ramie. Cold checks it and severe drought kills it. It is cultivated

in warm temperate climates rather than in the Tropics. Unless grown under irrigation or on moist bottom lands along rivers it requires at least 40 inches of well-distributed rainfall. Its roots are

FIG. 1.—Second growth of ramie, showing the crop ready for harvest two months after cutting the first crop.

injured where the ground freezes more than 3 inches. There should be a period of at least five months free from frosts. In the Tropics it grows throughout the year unless checked by drought, but its productiveness is not thereby very much increased.

SOIL.

Ramie requires a rich, deep, moist soil, well drained, yet not subject to drought. A dark, rich, sandy loam is best. Rich, alluvial bottom lands free from overflow are suitable for it. The plant will not grow in undrained swamps or on stiff clays, and its cultivation is not profitable on light sandy soils unless heavily fertilized.

FERTILIZER.

Ramie requires a fertile soil and, as its growth should be continued five years or more on the same land and heavy crops removed each year if it is to be a profitable crop, the fertility must be kept up by liberal applications of stable manure or commercial fertilizer. Table I, from Bulletin 94 of the California Agricultural Experiment Station, by Prof. E. W. Hilgard, indicates the elements removed from the soil by ramie.

TABLE I.—*Soil ingredients (in pounds) withdrawn from 1 acre by a crop of ramie.*

Soil ingredients.	Leaves (4.25 tons).	Stalks (7.25 tons).	Bark (2.75 tons).	Whole plant (14.25 tons).
Potash	68.13	155.99	27.86	251.98
Soda	8.99	33.63	7.52	50.14
Lime	566.91	71.77	19.14	657.82
Magnesia	114.58	43.68	10.01	168.27
Manganese oxid	1.92	1.45	0.20	3.57
Ferric oxid and alumina	38.56	12.16	0.71	51.43
Phosphoric acid	77.13	67.71	10.86	155.70
Sulphuric acid	30.86	14.53	3.17	48.56
Silica	692.71	7.06	4.48	704.25
Chlorin	41.56	2.50	7.79	51.85
Total ash constituents	1,641.35	410.48	91.74	2,133.57
Nitrogen	206.10	105.85	57.75	369.70

Table I shows that the leaves, constituting nearly one-third of the total weight of the plant, contain more than two-thirds of the total ash. The leaves and stalks should be left on the farm. The bark containing the fiber is the only portion having a market value. It is the only part that needs to be removed from the farm, and its proportion of fertilizing elements is relatively small. Ramie requires more potash than wheat, but less phosphoric acid. If the leaves and stalks after decortication are returned to the land they will aid in keeping up the supply of humus in the soil; otherwise, stable manure must be liberally applied, unless winter legumes, like crimson clover, can be grown, to be plowed under in the spring.

PROPAGATION.

Ramie is propagated by root cuttings or by seeds. The plants may be more abundantly multiplied from seeds, but they grow more quickly and with more certainty from root cuttings. Seeds must be

sown on the surface of the ground in a well-prepared seed bed, which must be covered with cloth to keep a warm, saturated atmosphere until they germinate and take root (fig. 2). When 6 to 10 weeks old they may be transplanted to a nursery in the open ground, and two months later, when well rooted, they may be set out in the open field. The young plants or roots are set 20 to 30 inches apart in rows 3 to 4 feet apart. The land between the rows must be cultivated. If irrigated, the furrow system must be used to avoid covering the young plants with water.

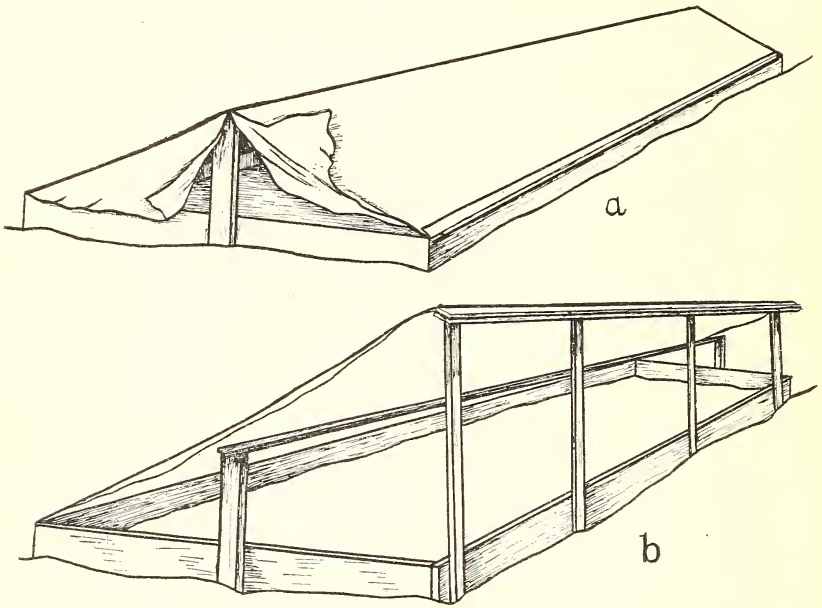

FIG. 2.—Ramie seed bed covered with cloth to retain heat and prevent evaporation: *a*, Cover to remain closed until seedlings are up; *b*, cover raised on one side to give ventilation with partial shade.

HARVESTING.

The first stalks of ramie are usually much branched and of no value. It is best to cut off the first shoots when they are 10 to 30 inches high, to induce a thicker and more uniform growth of shoots. Afterwards one to four, usually two, crops are cut each year. In Asia, where ramie is commercially cultivated, it is cut by hand. Each stalk is cut as it matures, leaving the younger stalks to grow. The harvest there is almost continuous in the small hand-tended patches. No special machinery has been devised for cutting ramie. It may be cut with self-rake reapers, such as are used for hemp, and must be kept straight. If to be decorticated green it must be gathered up immediately after cutting, but if to be decorticated when dry it should be

cured in the swath or gavel like hemp, and care must be exercised to avoid heating or molding.

PREPARATION OF FIBER.

In Asia, the bark, including the fiber, is stripped from the stalk immediately after it is cut. The thin outer skin, which clings tenaciously, and the green pulp are scraped from the fiber by drawing the fresh green strips of bark between a bamboo thimble and a blunt knife held in the hand. The strips of bark with the fiber are called "ramie ribbons." This term has also been applied to the fiber decorticated by machines. The hand-cleaned fiber free from the bark and pulp is called "China grass," and in this form it is baled and exported.

DEGUMMING AND COMBING.

In order to be spun into fine yarns by machinery, ramie must be degummed and combed. The degumming is a chemical process, removing the gums and leaving the fiber soft. After being dried the degummed fiber is put through a series of drawing machines to separate and straighten the individual fibers and then through a combing machine to remove the short fibers or "noils," leaving the clean, straight, long fiber, or filasse (called "tops"). Both tops and noils are spun, the tops making the finest and strongest yarns. The degumming and combing processes are carried on at the mills and not by the grower or producer of the fiber.

YIELD.

The yield of ramie stalks and the percentage of fiber vary widely under different conditions. The yield of stalks usually increases up to the fourth year. The estimates shown in Table II, based on numerous experiments in France, are suggested as an aid in estimating the probable output under favorable conditions in this country.

TABLE II.—*Estimated yield per acre (in pounds) of ramie stalks and fiber.*

Years.	Green stalks.	Air-dry stalks.	Dry fiber.
First	6,000	1,500	300
Second	12,000	3,000	600
Third	18,400	4,600	900
Fourth	26,400	6,600	1,300

A series of statements of eight different authorities as to the yield of raw fiber from two annual cuttings in experimental plantings ranges from 500 to 2,800 pounds, with an average of 1,293 pounds. The yield of dry fiber is 3 to 5 per cent of the weight of the green

stalks, or 15 to 20 per cent of the weight of the air-dry stalks. In Taiwan (Formosa), where three or four crops are harvested each year over about 5,000 acres, the average annual yield is about 700 pounds per acre. In Hunan and Hupeh, China, the annual yield is 400 to 600 pounds of China grass per acre from three crops.

MARKET.

China grass, which is ramie fiber cleaned by hand in China, can be delivered in San Francisco or New York at 6 to 10 cents per pound. If it is to be produced in this country it must compete in quality and price with that imported. It is not listed separately in the statistics of imported articles, so there are no exact figures available as to the quantities imported. It is roughly estimated that the importations of China grass now amount to nearly 1,000,000 pounds annually, besides considerable quantities of yarns and some degummed filasse prepared in Europe. No regular market for ramie fiber has been established in this country, and it is not listed with American quotations of other fibers. Ramie ribbons and China grass are both quoted in the London fiber market. Hongkong is the principal shipping port for the fiber, but it may be purchased in nearly all the ports of China and also in Taiwan (Formosa).

USES.

Ramie is used in this country principally in millinery goods, knit underwear, dress goods, for mixing with silk, and for shoe thread. It is suitable for dress goods, plushes, upholstery materials, portieres, table napery, incandescent gas mantles, and nearly all lines of goods now made from silk or linen yarns. It is distinctly different, however, from either silk or linen. It is especially suitable for goods in which strength, nonelasticity, absorbent properties, and luster are required.

DECORTICATING MACHINES.

The lack of satisfactory mechanical methods for separating the fiber from the woody inner portion of the stalk and from the thin outer bark has made it impossible to produce the fiber with profit outside of countries having cheap, skilled, hand labor. Many machines have been devised for decorticating ramie and some have been built, but very few have been actually used in the field. Most of the machines have lacked either efficiency in cleaning the fiber or capacity sufficient to enable them to compete with the work as it is done in China. At the present time three different companies in Europe are advertising machines for decorticating ramie fiber from the green stalks. Very promising work was done in trials in the fall of 1911 with a machine built in this country to decorticate ramie

fiber from the dry stalks. If this machine does as well in actual commercial work as it has in the rather extensive trials, it may be regarded as satisfactory for decorticating the dry stalks. Fiber decorticated from green stalks is desired for most degumming processes, and machines are now being perfected for this work.

The outlook for the ramie industry in this country appears promising. At least five different companies are operating mills for degumming, combing, and spinning ramie. The manufactures of ramie yarns, shoe thread, dress goods, and incandescent gas mantles have become established industries. Increasing quantities of ramie goods are being offered under the name "ramie," so the purchasing public may soon learn to recognize the merits of this superior fiber. In some instances its reputation has been injured by goods made of badly degummed fiber wearing out quickly in the laundry, by goods made of noils sold to compete with the better grades made from tops, and, worst of all, by cheap jute goods sold under the name "ramie."

The importations of raw ramie fiber from China and of degummed fiber and ramie yarns from Europe, the established manufacture of ramie goods in this country, and the increasing demand for these goods indicate clearly that a market for the fiber is assured. The question remains for the American farmer, Can this raw fiber, the yield of which is scarcely more than 4 per cent of the weight of the green crop, or 800 to 2,500 pounds per acre, be produced at a cost permitting it to compete with the hand-cleaned ramie fiber from China?

Approved:

JAMES WILSON,
Secretary of Agriculture.

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